2020 Forest Insect and Disease Highlights: Colorado

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A key part of forest management is the regular monitoring for damage caused by forest pests. In Colorado, the primary source of information on forest pest conditions is an annual Aerial Detection Forest Health Survey. This is a cooperative program led by the U.S. Forest Service (USFS) with Colorado State Forest Service (CSFS) participation. Trained aerial observers from both agencies typically fly over the majority of the state's approximate 24 million acres of native forests in small fixed-wing aircraft to map and classify the intensity of the current year's damage. When necessary, some areas flown also are ground-checked to verify the agent (i.e., insect) responsible for the damage and/or the severity of damage.

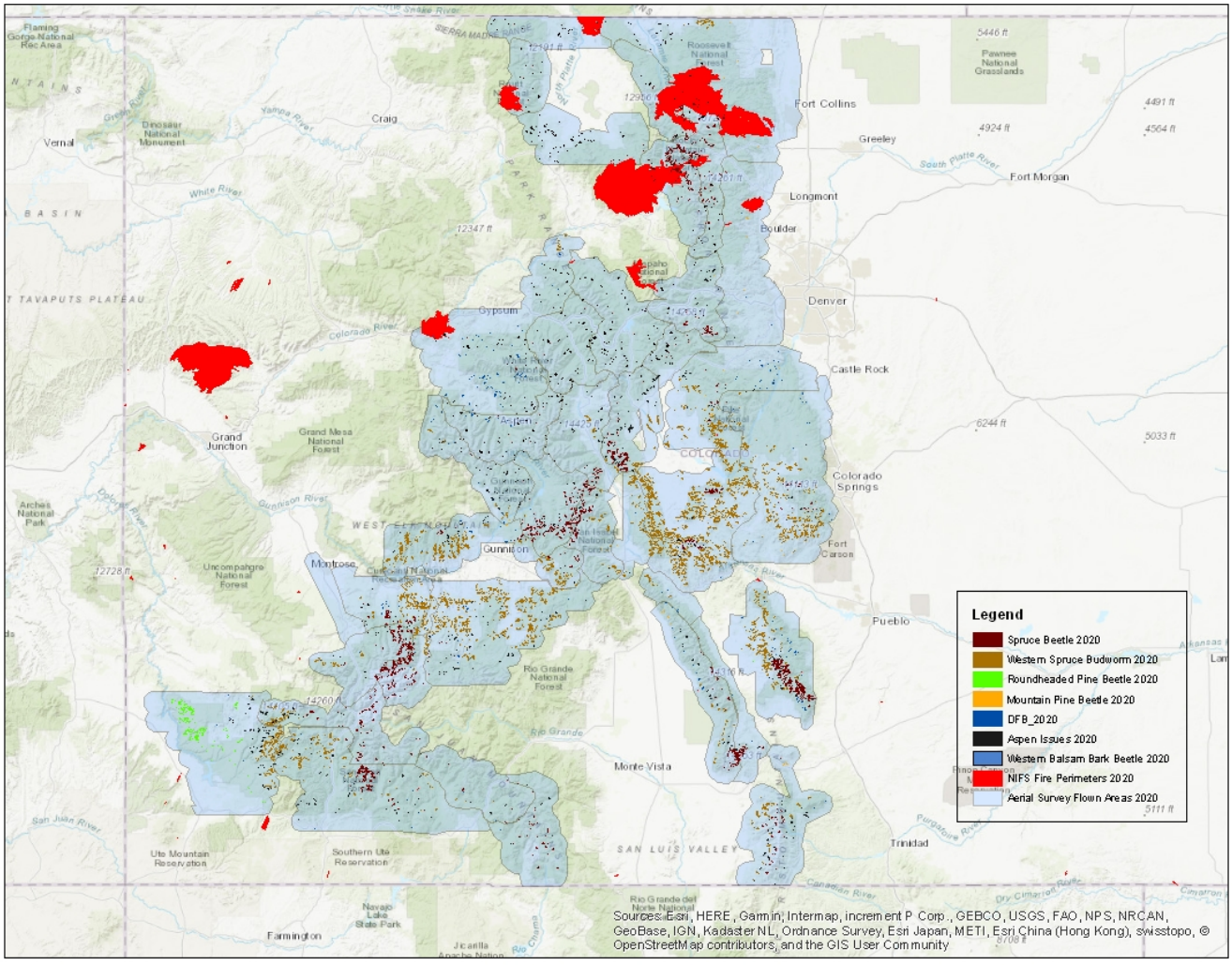

Figure 1. Map of areas flown by the Aerial Detection Survey Program relative to disturbance in Colorado in 2020.

Priority Areas for 2020 Survey

Due to COVID-19 pandemic safety protocols in 2020, trained aerial observers from both the CSFS and USFS flew over designated priority areas. Forested areas across Colorado were designated as having a "high" (red), "moderate" (blue), or "low" (grey) likelihood of widespread, destructive forest disturbance (tree mortality). Areas identified as "high" priority were flown first, followed by "moderate" priority areas.

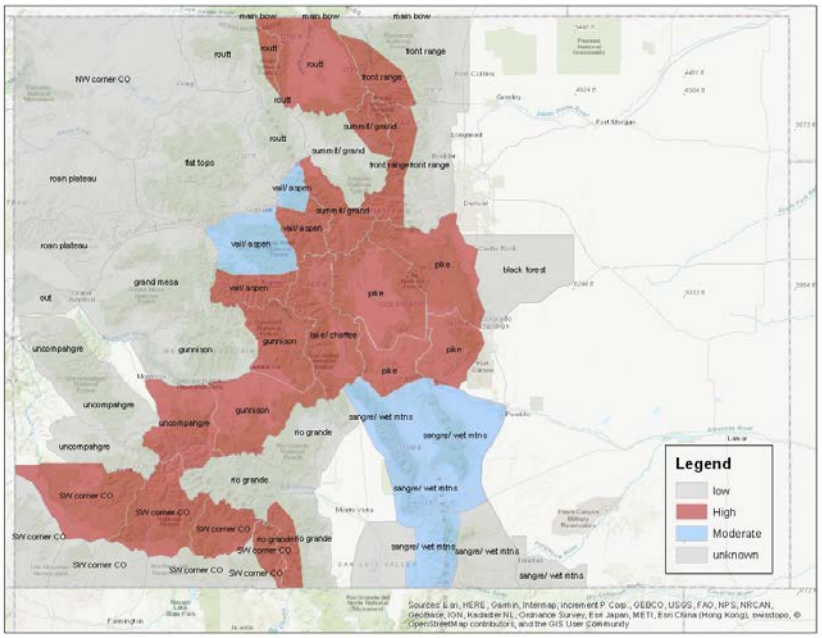

Figure 2. Priority areas designated for aerial detection survey in 2020.

Areas observed in 2020

Due to COVID-19 pandemic precautions and restrictions, 16.3 million acres were monitored from aircraft in 2020 (depicted in light blue), compared to 30.2 million acres flown in 2019. Areas designated as "high" priority and "moderate" priority were recorded from aerial survey flights in 2020. Areas considered "low" or "unknown" priority were omitted from this year's survey to reduce COVID-19 exposure to trained observers and pilots.

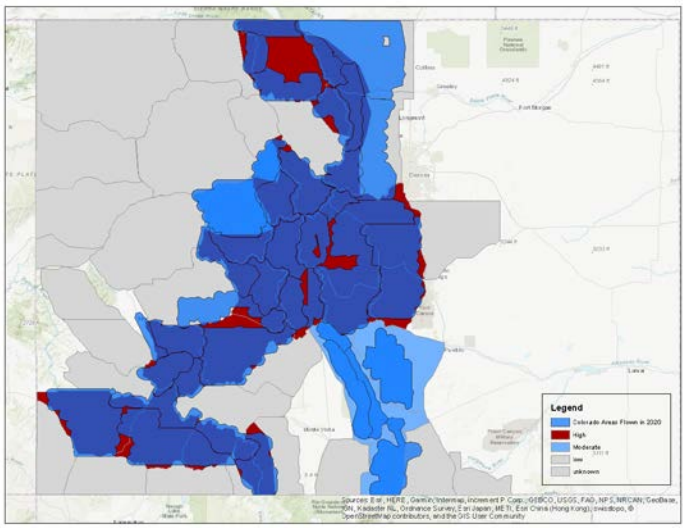

Figure 3. Areas flown in 2020 through the Aerial Detection Survey program

Warmer than average temperatures

The past year was exemplified by drier than normal conditions and above average temperatures, though not quite record breaking for most locations (January through November). From 1901-2000, the average temperature in Colorado was 47.6°F. In 2020, from January through October, the average temperature was 50.2°F, or 2.6°F above average.

Freeze Damage

October 9 and 10, 2019 had temperature extremes which dropped around 70 degrees F in a single day. The following April, temperatures dropped from the mid-70s F to single digits within 36 hours. The one-two punch left trees damaged, and many species experienced widespread mortality. Conifers, ash, maples and other thin-barked trees suffered severely along the Front Range.

Below average precipitation

The impact of below average precipitation in 2020 may cause a reduced defense response in trees against invading bark beetles, setting the stage for increased activity in 2021. In 2020, the average accumulated precipitation was 10.3". From 1901-2000, the annual long-term average accumulated precipitation is 15.97", marking 2020 as the second driest year on record, 5.59" below the average.

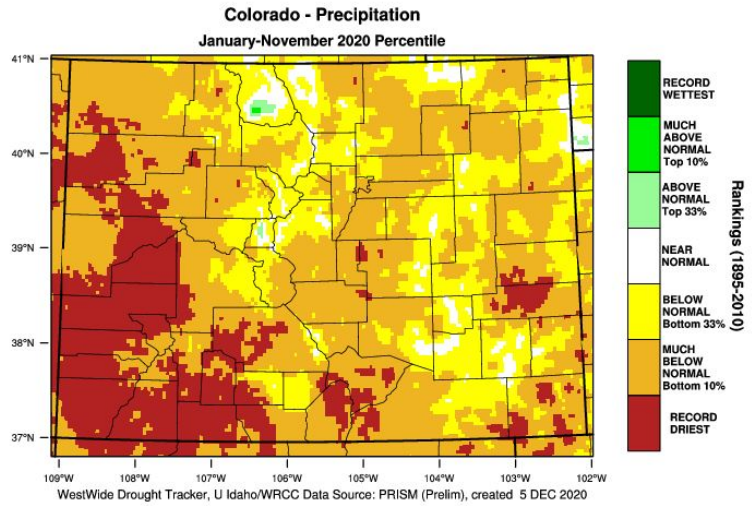

Figure 4. Percentile of normal accumulated precipitation in 2020. Much of Colorado recorded at least the 10th percentile of average precipitation in 2020.

Bark Beetle-Fire Interactions

Bark beetles have affected many of Colorado's forests in recent decades, altering the arrangement of wildfire fuels in these forests. Since the mid-1990s, mountain pine beetle has affected roughly 80%, or about 3.4 million acres of ponderosa-lodgepole pine, while the spruce beetle has caused tree mortality in approximately 40% of Colorado's high-elevation Engelmann spruce forests. When a wildfire ignites in these forests dense with beetle-killed trees, the resulting fuel arrangement affects the fire's behavior.

Trees recently killed by bark beetles have less moisture in them, classifying these dead trees as heavy fuel capable of sustaining large, catastrophic fire. In addition, a few years after attack by beetles, tree canopies fade from green to red as they lose moisture in their needles and branches. These recently faded tree canopies serve as ladder fuels which can carry fire into adjacent tree crowns, known as active

crown fire. Crown fire behavior was responsible for the large “runs” that consumed vast acreages of forest in short duration during many of Colorado’s wildfires in 2020.

After the Fire

The interactions between bark beetles and wildfires are complex. The physical arrangement and condition of fuels in the forest, wind conditions and fuel moisture in trees all intertwine to affect wildfire behavior – and pose a higher risk of catastrophic fire.

Extreme wind conditions were ever present during the East Troublesome and Cameron Peak fires, helping flames consume large acreages of forest in short duration. Timing of forest management activities are critical in these pre- and post-fire forests to reduce tree loss and reduce hazards to infrastructure and property.

Colorado's largest wildfires

Three fires in 2020 top the list of largest fires in Colorado's wildfire history. Fuels, topography and weather all aligned to allow vast forested acreage to be consumed.

Year	Name	County	Acres
2020	Cameron Peak	Larimer	208,913
2020	East Troublesome	Grand	193,812
2020	Pine Gulch	Garfield	139,007
2002	Hayman	Douglas, Teller	137,760
2013	West Fork Complex	Hinsdale, Mineral	109,049
2018	Spring Creek	Costilla, Huerfano	108,045
2012	High Park	Larimer	87,250
2002	Missionary Ridge	La Plata	71,739
2018	416	La Plata	52,778
2008	Bridger	El Paso	46,612
2012	Last Chance	Washington	44,000
2018	MileMarker 117	El Paso	42,795
2016	Beaver Creek	Jackson	38,380
2018	Badger Hole	Baca	33,609
2002	Trinidad Complex	Trinidad	33,000
2020	Grizzly Creek	Garfield, Eagle	32,631
2017	Logan	Logan	32,564
2002	Mount Zirkel Complex	Routt, Jackson	31,016
2002	Burn Canyon	San Miguel	30,573

Figure 5. Largest wildfires in Colorado (acres). Data derived from the National Interagency Fire Center. Several fires in 2020 are still active at the time of publication and fire acreages may be updated to reflect incidence thereafter.

All of the twenty largest fires in Colorado's recorded history have occurred since 2000, a result of changing climate patterns and heavy fuel loads in forested ecosystems.

Spruce Beetle in Engelmann Spruce

Spruce beetle continues to infest high-elevation Engelmann spruce throughout much of Colorado. Since 2000, this small, native bark beetle has affected at least 1.88 million cumulative acres of forest. Newly infested forests within eastern Gunnison and western Chaffee counties continue to experience severe, intense infestations. Spruce beetle populations in 2020 further intensified in Hinsdale, San Juan and La

Plata counties. Beetle outbreaks in Huerfano and Custer counties continue to expand, though the intensity has slowed. In Grand County, the intensity of infestations has declined from past years as the beetle continuously depletes large-diameter Engelmann spruce from the forest.

Figure 6. Wolf Creek Pass with severe bark beetle-caused mortality in high-elevation Engelmann spruce in 2020.

Figure 7. Newly faded tree canopies from Spruce Beetle in high-elevation Engelmann spruce trees in Chaffee County in 2020.

Roundheaded Pine Bark Beetle

Roundheaded pine beetle (*D. adjunctus*) and associated native bark beetles (western pine beetle, mountain pine beetle, Ips engraver beetles) continued to attack previously uninfested stands and groups of 5-10 trees within currently infested stands within Dolores County. Intensity of beetle activity continues to remain high in localized areas of the San Juan National Forest. Further to the south, affected areas within La Plata County are seeing pockets of affected trees expanding, though incidence and intensity remains low.

Continued drought conditions in 2020 have stressed trees, predisposing trees to attack in the coming 2021 beetle flight. Adult bark beetles in the area typically begin flying in May and complete flights by early December.

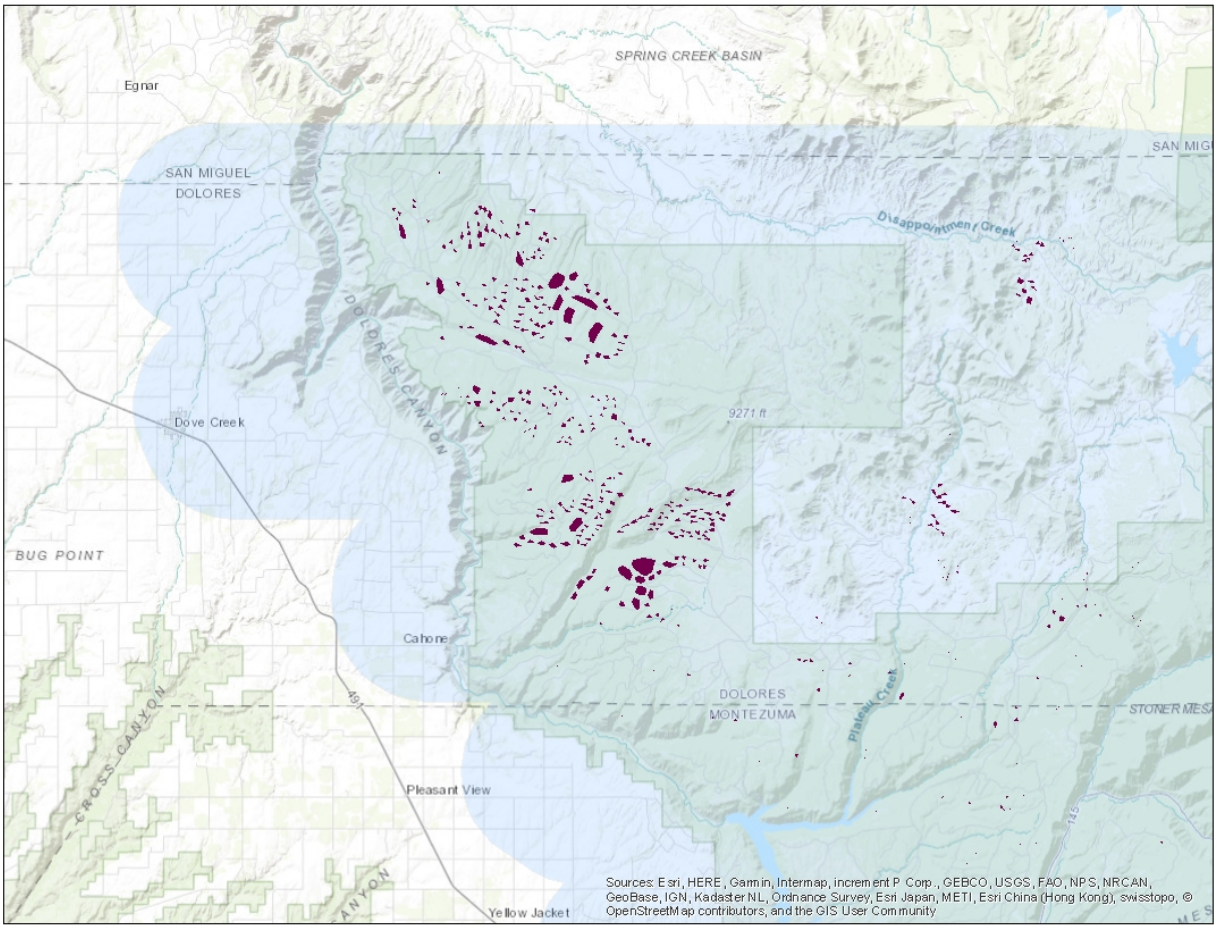

Figure 8. Areas of Roundheaded Pine Bark Beetle and associated native bark beetle-caused mortality in Dolores County, Co in 2020.

Aside from localized intense pockets, overall intensity of bark beetle activity across the forest in Dolores County remains fairly low, with only approx. 3,000 acres affected in 2020. Variability between observers in the aerial survey program is evident from 2019 to 2020. Although fewer acres were recorded in 2020, the intensity of areas noted were greater than in 2019.

Figure 9. Groups of ponderosa pine mortality from bark beetles in the Glade in 2020.

Douglas-fir Beetle

Douglas-fir beetle continues to cause significant Douglas-fir tree mortality in the central and southern forests of Colorado, having depleted many of the largest trees in this area of the state over the past decade. Gunnison, Saguache, Hinsdale and Mineral counties continue to see severely affected Douglas-fir stands.

Figure 10. Douglas-fir beetle and Western Spruce Budworm disturbance in Saguache County in 2020.

While many of the larger diameter trees have experienced mortality in recent years, smaller diameter trees are now susceptible to attack and are currently succumbing to the Douglas-fir beetle. Drought conditions exacerbated Douglas-fir beetle activity in 2020, and the summer of 2021 is forecast to see significant bark beetle-caused tree mortality as a result of the ongoing drought.

Figure 11. Douglas-fir Beetle and Western Spruce Budworm damage in Saguache County in 2020.

Mountain Pine Beetle

Mountain pine beetle affected approximately 80% of the pine forests in Colorado from 1996-2014. Although not every tree was affected in every acre of pine forest, many of the largest, most susceptible ponderosa and lodgepole pines were depleted in this outbreak event. Mountain pine beetle is a native bark beetle that persists in weakened trees, often from drought or from other stressors.

Individual trees and/or small groupings of trees have been affected along the Front Range. The Taylor Drainage in Gunnison County has been affected more significantly. Drought-stressed lodgepole pine have become susceptible and have been attacked all throughout the area, though the incidence and severity on overall acreage of pine forests in the area are considered low.

Figure 12. Mountain Pine Beetle-caused mortality in the Taylor River drainage, 2020.

Western Spruce Budworm

Western spruce budworm is a defoliator of Douglas-fir, white fir, and Engelmann and blue spruce. In its caterpillar stage, the insect partially consumes the needles, leaving a rust/burnt color to the remaining foliage not fully consumed by the budworm.

Trees damaged by western spruce budworm over numerous years are at high risk for attack by Douglas-fir beetle, which can build populations quickly and cause widespread mortality.

Forests in south-central Colorado with infestations of the western spruce budworm continue to experience intense disturbance, with Saguache, Gunnison, Chaffee, Park and Fremont counties among the most affected in 2020.

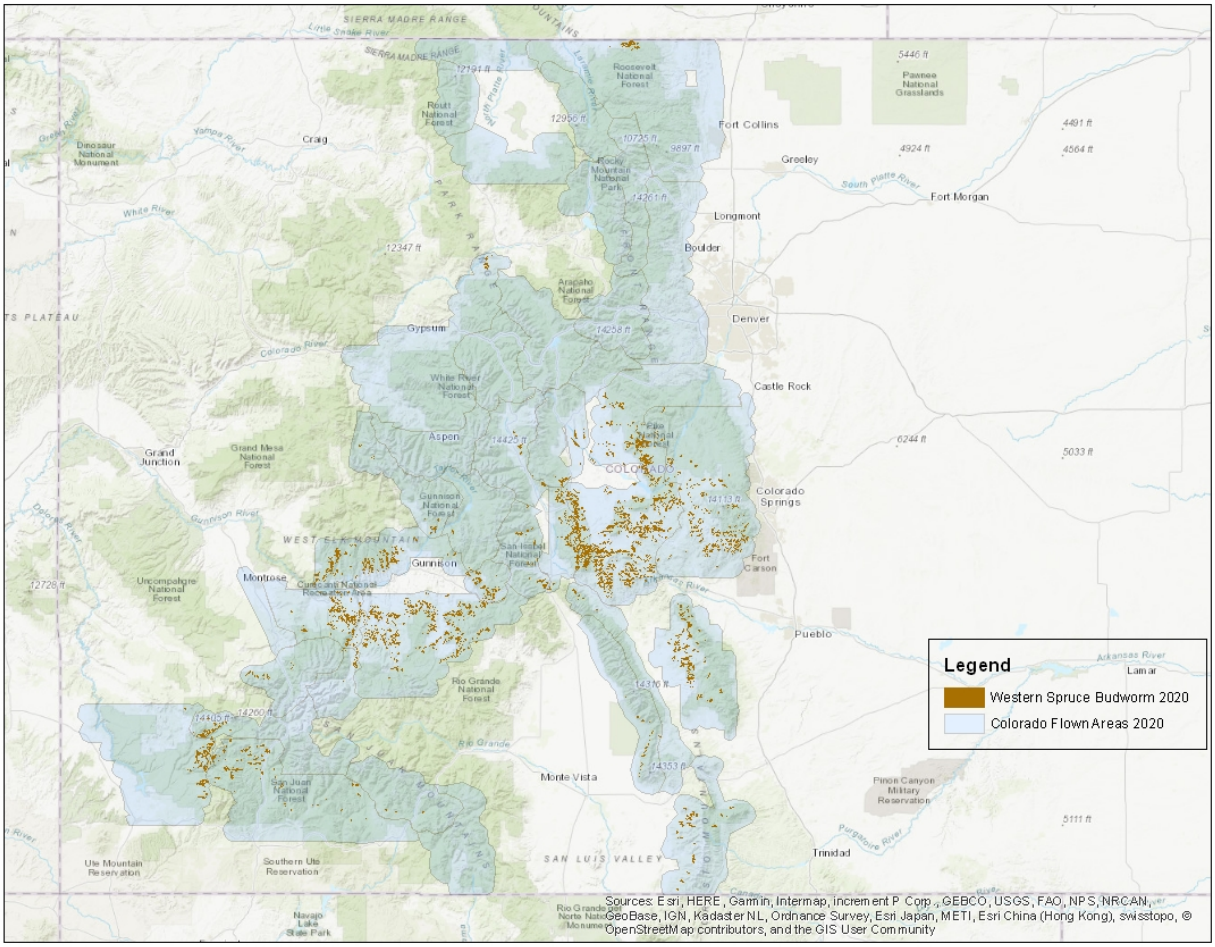
Legend
Western Spruce Budworm 2020
Colorado Flown Areas 2020
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

Figure 13. Areas of recorded Western Spruce Budworm relative to flown areas by the Aerial Detection Survey Program in 2020.

Figure 14. Western Spruce Budworm-caused defoliation in Park County in 2020.

Western Balsam Bark Beetle 2020

Root disease and western balsam bark beetle often co-occur in forests of Colorado. These areas serve to build populations of bark beetles. In years of drought, like in 2020, built up populations of the beetle can attack otherwise healthy trees that have been predisposed by a lack of precipitation.

Aspen Issues 2020

With severe and extreme drought conditions across much of the state, fungal issues in aspen stands were minimal. Drought-caused stress was prevalent in the central and southern counties across the state. Drought causes leaves to have browning at the outer margins and possibly drop off the tree prematurely. Drought and fungal issues in aspen can cause the spectacle of fall foliage viewing to be interrupted. The past year brought all of the above symptoms on many aspens in Colorado.

Figure 15. Drought-caused outer margins of the leaves turn brown and die back. Photo credit: private residents in Gunnison County 2020.

Defoliation from large aspen tortrix and forest tent caterpillar was evident in the central portions of Colorado in 2020.

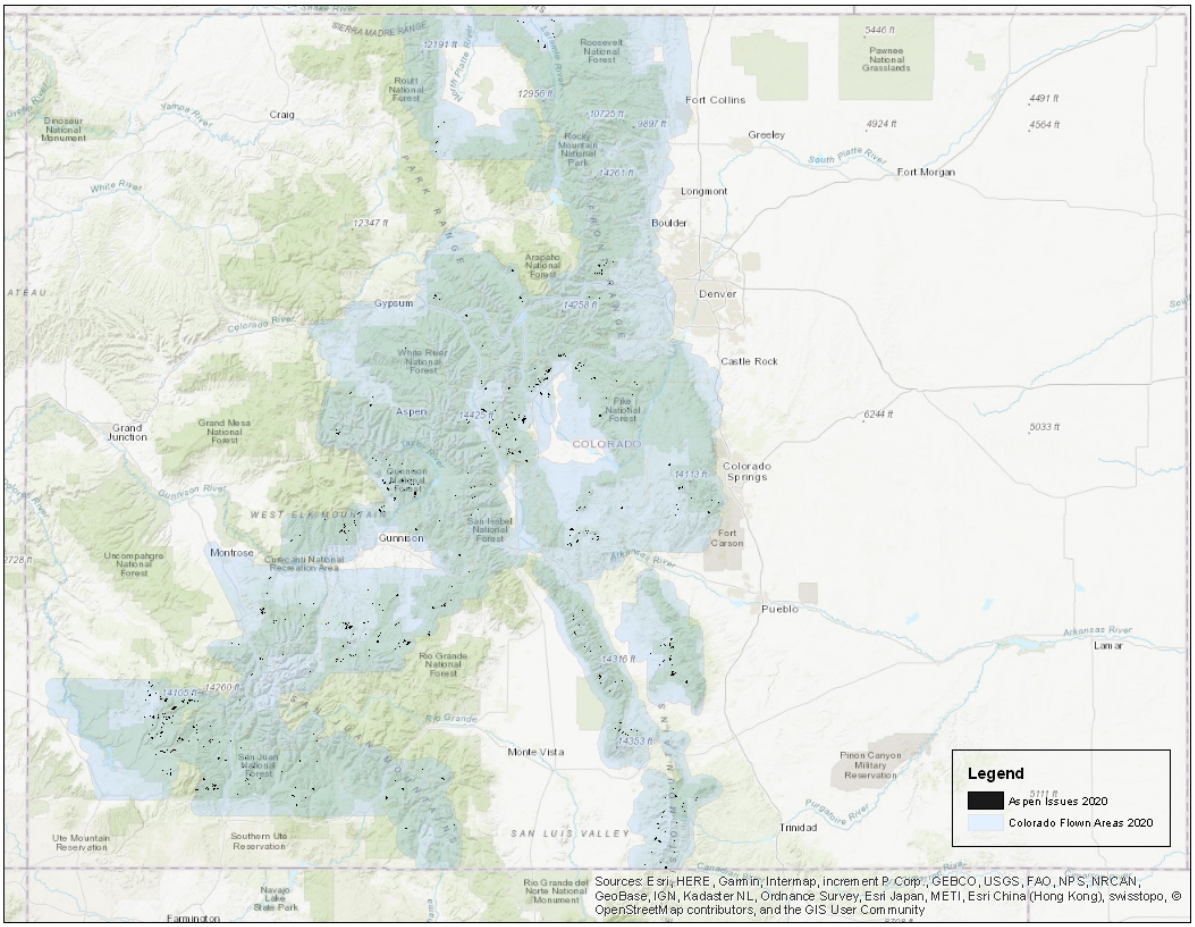

Figure 16. Areas of aspen disturbance in 2020 within Colorado.